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ABSTRACT

Policy and practices in the use of computers in education in Greece and in education for computer use are reviewed. Given the centrally controlled and funded educational system in Greece, major decisions that involve major funding must be considered at the highest levels of decision-making. Computers began to be introduced in Greek schools at the higher education and secondary school levels around the time that Greece joined the European Community in the early 1980s. Efforts were planned to introduce technology to conform to the stated policies of other European countries. Teacher education became an essential aspect of these efforts. Those teachers with computer experience had acquired skills traditionally related to computer technology rather than those needed to introduce computers to students. Policy considerations in training teachers and introducing new technology are explored. At present, the direction of the educational system seems to be toward informatics and not toward education, and it is unlikely that the training of teachers will evolve in the direction of teaching students to use computers rather than making computer education an aspect of the science and mathematics structure. (SLD)

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Computer education policies and the cultural context *

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1. The introduction of computers in education: national policy issues

Greece is a country with limited resources struggling to achieve a balance between the demands set forth by the national and international economic and political imperatives and the demands of its people for an increasingly better life secured mainly by provisions of the State.

With that as a point of departure, and given the centrally controlled and funded educational system[1], any major decision regarding education and involving major funding has to be considered at the highest levels of decision making. Issues of potential political expediency such as the provision of computers in education are by far within such political practice.

In addition, in a country like Greece, where teacher-centered education and centrally controlled educational policies do not leave any real possibility for change once a policy is established, it is really crucial to be able to identify the forces which shape the evolution of an innovation within the educational system. To do that we need to analyse the interplay of current facts shaping educational policy with the educational and socio-cultural developments which are related to history and political process.

As the World is approaching the end of this century and as the development of new technologies brings it closer, but may be also further apart, Greece finds itself once more at the cross-roads. For one the strive to proceed in the European cohesion - mainly economically and technologically - absorbs a good part of the

[1]For a description of the structure and decision making of the Greek educational system see Kontogiannopoulou-Polydorides, G. et.al (forthcoming) Greece: System of Education. In T.N. Postlethwaite International Encyclopedia of Education

*The empirical data on which this analysis is based is the data derived from the National Case Study COMPED and the school survey data of the Computers in Education research project. The project was carried out by a research unit in the frame of the Greek National Center of IEA at the University of Patras. For complete information on the project see:
i. Pelgrum + Plomp (1991)
ii. Kontogiannopoulou-Polydorides, G. et.al (1992)

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country's resources; at the same time the political and military activity/fluidity in the Balkan area creates severe problems of national and international integration and stability at the same time. On the one hand technological integration and cohesion imperatives have fostered the heavy burden of introducing computers in education at a much faster pace than the country was prepared to achieve. On the other hand economic cohesion and integration require that Greece explores and expands into "new markets" in which other European Community countries are already looking into.[2]

"New markets" means the possibility of production and commerce expansion which requires competitive products and services, nowadays walking hand in hand with the use of new technologies. So any new venture is simultaneously bringing in the surface the development of the country's productive forces. Keeping this in mind, let us now concern ourselves with the issue which reflects educational innovation and technology in this specific context: Computers in Education.

The issue of computers in education evolved in the beginning of the last decade, when none of the above problems had arised. In fact it evolved at a time when the country was experiencing a double euphoria: First, full participation in the European Community was achieved in 1981 - as planned since much earlier, in the 60's - and second the country had a new government with a stated completely different political orientation than before, socialism.

At that time, a small number of computers was used mainly by part of the private sector, some research institutes, and by a small fraction of the public sector. There was practically nothing at the level of primary and secondary education. Government policy adopted in principle some European Community policies and recommendations as stated in the official Ministers of Education Council's decisions[3].

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[2]These new markets definitely include Eastern European countries, a number of which are situated in the Balkan peninsula and are, one way or another, involved in the current "destabilizing" events. Needless to say that a number of factors would render the Balkan peninsula countries with a likelihood for economic and technological liaisons with Greece much more than any other group of countries.

[3]European Community policy regarding new technologies in education was adopted by European Ministers of Education on September 19, 1983 and is published in the Journal Officiel, No256, 24 Sept. 1983. Greek policy has - since then - been planned and legitimized on the basis of the above EC policy. Kontogiannopoulou-Polydorides et.al. (1992) Ch.2.

European Community policies, while being general statements of intent - and not of imposition - they nevertheless masterfully promote, though covertly - a definite "model" of introducing new technologies in education. Their emphasis on the use of new technologies in teaching, curricula as well as the training of (existing) teachers and the training of trainers who will train teachers, point to a specific (right) direction[4].

The Greek version of official policy practice for computers education in the eighties can be summarized as follows:

a. high level professional education in university level computer science courses at the University of Patras
b. specialized training at the technological higher education institutes
c. initiation of lower level training at the technical and vocational upper secondary schools
d. extension of computer education in general lower secondary education
e. opportunities for teachers training and in-service training[5].

The rationale for introducing informatics (sic) in secondary education is stated and promoted in a number of cases, evolving around the following key issues[6]:

- Upgrading of production processes and products to achieve competitiveness within EC, through the training of the "appropriate manpower" in informatics
- Training of high level personnel to occupy positions at all levels of the occupational hierarchy and ensure the appropriate transfer and use of technology
- Supplying middle and lower level employees to reach the internationally advisable ratio of 1:2 (sic) - since the country already had a number of university level professionals educated in computer (and related) sciences abroad and more recently in Greece[7]
- Adopting guidelines of European Community policies regarding computers in education as well as Community funding of specific training programs in the use of new technologies.

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[4]See for example Kontogiannopoulou-Polydorides et.al (1992) Ch.2 for documentation on the above issues. The documentation is derived from the National Case Study of the IEA Computers in Education (Comped) research Phase 1.
[5]Ibid., p.22.
[6]Ibid., Ch. 2.
[7]Ibid., p.24

Elements of the implied rationale have been either publicized or documented in international organizations reports including official EC policy documents, United Nations reports, and others, revealing that the goals and the approach set forth is not the prerogative of the Government in the 80's. It is rather a political technological complex of agencies which promotes policies and, therefore, participates indirectly in decision making.

It is necessary to note that important issues emerge from such an adoption of an internationally held rationale: the first springs from the fact that it is the first time that positions of international fora are so explicitly taken into account in the initiation and formulation of educational policy.[8] The second is the very fact that nobody seems to worry about the possible proletarization of large segments of the work force within an international division of new technologies labor in which Greek working people are not likely to be the "thinkers".[9] The interplay of the imperatives of the new technology, the Socialist Government introducing the policies, and the European Community reinforcing an international approach has achieved to create what I would call a "passive' consensus. One of the very rare ones in education related policies to be achieved in the country.

Another important aspect of these developments is that a top Governmental body created specifically to formulate policy for the introduction and promotion of new technologies in the production and the public sector, at the same time issued directives regarding education[10]. Whether a substantive intervention to education

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[8]Interestingly enough this happens at a time when a socialist government is in charge, a government which has traditionally and persistently opposed any transfer of policies and/or practices form abroad, and any attempt to have national policy making influenced by international forces of any kind. Furthermore, it is interesting to note that neither the intellectuals nor the teachers (unions or not), normally very vocal and always critical, have any stated objection in this influx of strategic goals stemming from supra-national decision centers. Nor do they oppose the adoption of goals which have - for now at least - a solely vocational character at practically all the levels of the educational system.

[9]This is a very interesting development since it is well known that educational theorists and critics have never ceased to relate most problems of the educational system with the international division of labor and/or (internationally operating) mechanisms of control.

[10]The Governmental body was called Governmental Council for Informatics, consisted of top policy making officials and University Professors and often convened under the chairmanship of the Prime Minister himself. The Consultative Committee (of University professors) was operating at a lower level, consulting with the Minister of Education and supervising a Working Group of low rank experts, mostly secondary education teachers.

or a legitimizing function, it is clear that the concerns to provide new technologies appear to have top priority.

The private sector very quickly developed small training outlets in new technologies, by adopting appropriate vocational training private courses, to replace existing ones serving less profitable and often obscure vocations. These private sector schools have apparently done quite an efficient job in training the (below University level) personnel necessary for the production units moving fast to adopt new technologies, as well as the public sector agencies, at least the ones which were to follow[11]. They have also done, in my view, an unprecedently efficient job, through their own advertisements in the mass media, to create a quiet but massive campaign to support the government's not so adequately publicized effort.[12]

In the Government's rhetoric the computer, or rather informatics, appeared as a sine qua non for the educational system, and rightly so, for almost ten years later there is no questioning of this line of thought by either practitioners or educational theory analysts. What has not been widely discussed though is the approach to be taken when introducing computers in education. Such an issue is directly related to the question "in what context".

The domination of the factors presented above resulted in very specific policies which guided the introduction of computers in general education: First the adoption of a partial set of internationally promoted goals regarding the use of computers in schools - as presented above; second the limited number of computers and computer using schools - as a result of limited resources; and third, the control of the initial steps by engineers and not by educators - as we present in the next section.

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[11]In fact, while mainframe computers were very rarely part of the operations of large scale units - mainly in the private sector, and a small number of public agencies - microcomputers started being introduced quite extensively - though in a much slow er pace than in other EC countries. The small scale of Greek productive units matched much better of course with the new technology of the PC's (Ktenas, 1991)

[12]This was effectively achieved mainly through television and newspaper advertisements which were greatly intensified each year, at the time, when the university entrance examination results announced the one hundred thousand "failures".

2. Initiation policies and curriculum features

The initiation of informatics in the educational system was part of the government's upgrading technical and vocational education in the mid 80's and was implemented on two fronts:

First, as new specializations in the upper secondary technical and vocational schools, and, second, as part of the innovation introduced with the establishment of the new "multibranch" upper secondary schools.[13] Informatics in these schools was introduced as a subject per se, or, as a field of specialization to train low level employees. The initiation of informatics at this level followed the establishment of specialization courses at the university level[14].

It is necessary to note at this point that technical and vocational education, ever since the 70's, had employed in its ranks, as teachers, graduates of the prestigious Technical Universities of the country, who were hit by unemployment by the end of the seventies. It is mainly these engineers who, along with mathematicians trained as computer specialists - often in the above mentioned private education establishments - worked for the planning and implementation of informatics in the educational system[15].

Within this context computer education and computer use, promoted as informatics, is "taught" as a simplified reproduction of the classes initiated a few years earlier at the university. Informatics was, therefore, introduced as an independent subject and not as a tool or as a new technology geared to foster production through the increase of productivity and product competitiveness, as the initial goals for computers in education had advertised.

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[13]The later were introduced as an outcome of a World Bank project and were initially presented as a replica of the internationally known model of comprehensive schools. The Greek version, however, according to recent research studies, turned out to be more closely related to the technical and vocational upper secondary schools, rather than being a modern version of general education schools with a desirable technical and vocational component

[14]For one it is argued that these schools have not achieved their stated goals since practically all students-graduates are supplying for higher education, and, furthermore, since many students transfer to a general education school. More importantly the high costs involved will not permit their expansion much beyond their current number which is too small. On the other hand, the first Department of Computer Science was established at the University of Patras in the beginning of the 80's, followed by a Research Institute in Computer Technology at the same University. Other Departments or specialized courses followed later in universities around the country, with the University of Crete leading the way.

[15]It is precisely these experts who have been the nucleus of the Working Group for the Introduction of Informatics in Education at the Ministry of Education, under the supervision of a Consultative Committee comprised by University Professors of Computer Science. Their narratives and the documentation they have provided to the COMPED study are of great importance for this work.

Indeed the educational goals set forth by the Greek Government, as they evolve from statements included in the Presidential Decree 108/1987[16] are:

- Introduce a beginner's familiarization of students with the computer
- Provide secondary school graduates with sufficient training, so that they can be integrated in the production process, which is constantly transformed through the use of new technologies
- Encourage specialization of the future workforce in the technical use of the computers

Let us now address the features of computer education in the lower secondary general schools which is of special interest for two reasons: First since they comprise a more extended segment of the schools which are presently involved with computers. And, second, because general education at the secondary level addresses itself to the great majority of students - practically three quarters of the total.

The introduction of informatics in general education proceeds as an extension and transfer of developments in technical and vocational education, replicating in fact the same model. It is not a mere coincidence, nor without implications, the fact that the members of the Working Group, which was in charge of all course content, hardware and software policies, were to a large extent teachers in upper secondary technical and vocational education[17].

Modeling informatics for general education after technical and vocational education meant the introduction of traditional computer literacy courses and a programming language, mostly BASIC. The legalities in order to adopt these decisions required that (a) the procedures of course approval and adoption had to be followed, including mainly the procedural sequence followed by the Pedagogical Institute (the Ministry's official curriculum and textbook developer) and (b) implementation had to secure the training and appointment of teachers and the acquisition of textbooks, software and hardware.

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[16]Government Gazette 63/1987, s.A.

[17]This is a very interesting development: Having the general education computer activities modeled after the technical and vocational education corresponding courses; especially since, as it is widely accepted in the minds of Greek education theorists, technical and vocational education has been - wrongly in the theorists minds - modeled after the abstract, non specific, and superficially theoretical general education.

As the members of the Ministry's Working Group reported to the COMPED[18] research unit, the Pedagogical Institute legitimized all their decisions without interference, since the Institute lacked the appropriate expertise[19] to proceed in the curriculum and textbook planning phase, and employ the official procedures to approve the suggestions of the Working Group. This is an interesting deviation from the legalities holding for all subject matters, which allowed for some further developments, as we shall point out later on.

The lack of the appropriate specialization of teachers and the speed with which the Working Group or the policy makers of the Ministry - it is not clear which ones - felt compelled to proceed, brought about a second deviation from institutionalized process. That is the process for introducing a subject matter in school and appointing and/or hiring the corresponding teaching personnel. The lack of specialized prospective teachers, the lack of official and elaborate curricula, the lack of conventional wisdom and common sense body of knowledge on the topic[20] and the lack of textbooks, led the Ministry to adopt a set of unconventional for Greek policy practice procedures in order to implement informatics education.

More specifically:

- The Division of Secondary Education Studies[21], within which the Working Group is operating, surveyed the lower secondary schools of the country
- Information was collected as to which schools employed teachers involved with the use of computers and programming, as well as schools with available building space to be utilized as a computer laboratory
- This information was coupled by additional criteria such as the proximity to other schools which might thus gain access to the use of computers, or the proximity to available computer labs in schools of technical and vocational education
- Further consideration was given to secure that the distribution of computer labs in the country will not be geared to locating them only in schools of the major urban centers (sic)[22].

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[18]See above, note 4.

[19]This would mean a top Institute official appointed as first rank public servant, having a doctorate in the corresponding school subject matter.

[20]As, for example, would be the case in the introduction of an existing subject in a new schooltype

[21]This Division plays a very important role in the Ministry's operations since it is the agency which keeps constant communication with the schools of the country in order to furnish them with the decisions taken centrally to be implemented by the schools.

[22]Working Group for the introduction of Informatics in Primary and Secondary Education (1988)

And, of course, the major guiding principle was the restricted budget which , at the time of the first phase of the COMPED research, allowed for 90 schools of general lower secondary education to be supplied with a "Lab" of eight personal computers each.[23]

The "content" for computer education in secondary general schools was defined on the basis of the above processes as hardware description, programming principles, and a programming language, all of which defined informatics as a subject matter, legitimized by the Pedagogical Institute and controlled at different levels by the engineers of the Working Group, and of the Consultative (Computer or related Science) Professors' Committee advising the Minister of Education.

3. Computer teachers training policies

The available hardware and software and the content of education is of course the point of departure for such an innovation. But of equal importance is the presence of teachers who are able to use the hardware and software in developing an educational practice for such an innovation to be integrated in the schools.

Teachers of mathematics (mainly) and physics (to a lesser extent) serving in the general secondary education schools have developed on their own the capacity of programming (usually in COBOL or BASIC), the capacity to use the computer (what is normally called computer literacy), and the capacity to use software in the form of application packages, mainly databases and spread sheets. The results of the IEA Computers in Education research are very transparent in this respect:

95% of the teachers indicated some form of training in programming languages (e.g. Basic, Assembler, Pascal, Fortran)

88% of the teachers indicated some form of training on basic concepts about computers and computer systems

[23] A detailed description of the specific policies and processes is included in Kontogiannopoulou-Polydorides, et.al (1992) Ch.2 (in Greek). While a description of the hardware available in each schooling type can be found in Ibid., Ch.4. Today there is a total of 420 general lower secondary education schools having access to such a Lab, 25% of the total. See Georgakakos (forthcoming) Informatics curriculum in secondary education (in Greek).

77% of the teachers indicated some form of training on hardware (e.g. computer architecture, CPU, data flow control)

75% of the teachers indicated some form of training on wordprocessing

10% of the teachers indicated some form of training on various pedagogical/instructional aspects

27% of the teachers indicated some form of training on educational/recreational programs

2% of the teachers indicated some form of training on laboratory instrumentation

3% of the teachers indicated some form of training on telecommunications (e.g. electronic mail)/ networks

but no substantial proportion of teachers had any definite notion about the use of computers in education.

The teachers had acquired a body of skills which has been traditionally related to computer technology rather than the knowledge and skills necessary to introduce computers in the schools to be used by students.[24] Programming language skills, and especially those of BASIC and COBOL, acquired by the teachers to a large extent on the basis of pen and paper exercises, have little relationship with the practical use of the technology with hands on experience. It is rather an extension of the algorithmic concepts in mathematics. The same is true for the use of very few (a couple of) applications packages. In this sense, the character of computer education or the so-called informatics curriculum reflects to some extent teachers capabilities. The developed capabilities of the teachers are a result of a combination of factors such as teachers interests, interaction within the frame of local professional associations, chance, and a potential for occupational and income supplementing activities outside the educational system. In the Patras area for example the first set of factors lead to a unique development, that of a Logo special interest group of mathematics teachers who were actively working with each other, with children, and finally with the research unit at the University[25].

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[24]For an extensive description of teachers knowledge on computers see Kontogiannopoulou-Polydorides, et.al (1992) (in Greek), Ch.4 and Pelgrum and Plomp (1991), Ch.4.

[25]This group was working in the frame of the Hellenic Mathematics Association - Patras section and was related to National Center's COMPED research unit at the University of Patras. They participated actively in a teachers education seminar for the use of computers in education and a training of the trainers seminar for Logo (with M. Schaffer of the University of Hartford, one of the associates of S. Papert). The educational activities of the seminar are presented in Kontogiannopoulou-Polydorides et.al (1988) (in Greek).

The Ministry of Education was the major source of training support provided for the teachers who were undertaking teaching informatics in the designated schools. In fact the proportion of school principals, as well as that of teachers, indicating the Ministry of Education as the source of support in training is much higher in Greece than most countries participating in the IEA research, reaching 83%.[26]
Interestingly enough, the topics in which these teachers have received their training reinforces the pattern of their initial self-training as well as the contextual elements of curriculum orientation and teaching methods orientation of the educational system at large. Emphasis on content, abstract knowledge, and lack of a systematic pragmatic orientation are the fundamental characteristics of the content and methods of teaching in schools. These practices are replicated in all school subjects and are reflecting what is considered to be important and legitimate knowledge and ways of knowing.[27]
Teacher training in informatics for secondary school teachers, as organized by the Ministry of Education in 1988, followed exactly the same pattern of storing a package of general and abstract body of knowledge, with emphasis on programming, and the following time distribution.[28]

Programming	22 hours	70 hours
PASCAL/BASIC or COBOL	40 hours	
Special issues on Informatics (operational systems etc)	8 hours	
Application packages (Data Bases,Spreadsheets, Wordprocessing)		8 hours
Applications of Informatics in Business		6 hours
Discussion (finishing the Seminar)		2 hours
(Applications of Informatics in Education		0 hours)[29]

It is important to note again that what is in fact the essence of the first two topics of the training is pen and paper programming and programming language activity, occupying two thirds of the total time. Furthermore, the applications,

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[26]See for example Pelgrum and Plomp (1991), especially Table 4.7, page 64, where it is clear that only Germany and Luxembourg appear to have a similarly centralized training.
[27]For a more extensive analysis see Kontogiannopoulou-Polydorides (forthcoming) The Use of Computers in Greek Education: A European Perspective in Computers in Education
[28]Working Group for the Introduction of Informatics in Primary and Secondary Education (1988)
[29] The parenthesis and its content is mine.

which could possibly turn out to be a viable real computer practice activity, was scheduled to run for a total eight hours out of which four, at the most, would mean hands-on experience in the use of the computer and the software.

More importantly, while there is a unit addressing the question of the use of informatics in business, there is no comparable concern in addressing the question of the use of informatics in education. What is strikingly fearsome is the fact that at the same time two projects on computers in education were in progress, funded by the Ministry of Education. Both projects were initiated by the research unit at the University of Patras one year earlier (1987) in close cooperation with the Division within which the Working Group was setting the stage for introducing computers in schools and planning the teacher training module.[30]

The first was the IEA Computers in Education research project, funded by the Ministry of Education with the amount of $ 46.000, a sizeable sum at that time for Greece. The second project was the Interdisciplinary Training in Computers Education for teachers of secondary schools, with specific emphasis in Logo, authoring languages, social issues in the use of computers, and the like, beyond the training content to cover content "relevant" to the Ministry's practices. This project included a year-long preparatory phase (1987, during which the curriculum and the teaching material was prepared), training of the trainers, the training seminar itself, and the creation of a small library on computers in education.[31] This project too was initiated by the research unit at the University of Patras and funded by the Ministry of Education with the amount of $ 60.000.

The inability of the Ministry of Education to exploit its very own - limited - resources properly could be accidental or could be by choice. The first has to be ruled out since one of the Working Group's members worked in the COMPED research project, while the Director of the Division of Secondary Education Studies as well as the Councillor of Technical and Vocational Education at the Pedagogic Institute were closely related to the projects since their very beginning.[32] So we are left with the only other alternative of such an event: it was done by

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[30]See above, notes 18 and 19.

[31]See also above, notes 22 and 24.

[32]Both of them were members of the National Committee advising us on administrative and decision making issues of the IEA research project. See for example the list of experts in the relevant committee in Greek National Center of IEA,"Structure and persons in the Greek National Center of IEA", Newsletter No1,1993 Patras: Dept of Education, University of Patras (in Greek and in English).

choice. It is not very clear though, although a number of hypotheses could be stated, as to why the Division would by choice "ignore" activities which were supported by specific Division people and Division activities. What is clear, however, is the fact that the interplay of traditional modes of content definition in education and the control of the first introduction of computers in secondary general education by (engineers of) the Working Group and the Consultative Committee resulted in further control of the content of teachers-in-service-training by the same forces.

4. Educational innovation, educational culture and policy control

One can assume that there has been a conscious decision at a higher policy level according to which the links of computer education in schools with higher education were to be realized in the Departments of Computer Science and related institutions. There was no provision and no interest for any participation of and or collaboration with the Departments of Education. The reason is control of any activity related to computers in schools by Computer Science or Electrical Engineering or Physics experts participating in the Consultative (professors') Committee advising the Minister of Education at that time[33].

The question we are faced with now is the "why" and "how" of policy making. That is why did the interests represented in the Committee would control computer education related activities in schools, and how were they about to achieve this.

Some additional data is relevant in order to further proceed with this question: First, the fact that a new Department of Computer Science was established at the University of Athens, from faculty members of the traditional Physics Department. Concurrently a new "Teachers' Yearbook"[34] was established to include graduates of computer related courses of study, who are of course engineers or computer science graduates and cannot be considered as teachers, no matter how vaguely

[33]See above, notes 8 and 14.

[34]A waiting list of prospective teachers of specific specialization, to be appointed to schools.

one would interpret the meaning of teaching and the professional identity of teachers.[35]

So educational policy in introducing computers in school "creates" teachers by Law, where teachers do not exist, defining, therefore, accordingly what the content, character and structure of computer education in schools will be.

The above data reveal a pattern, which has been witnessed in Greece over and over throughout the history of the evolution of the education system: The integration of discipline educated scientists and/or professionals in the education system as subject "teachers", and the perpetuation of a single emphasis on what has been traditionally considered useful knowledge and the way to appropriate that knowledge, which is memorizing mainly the abstract content of the subject matter. This is duly intensified by a number of factors:

a. the relative limited opportunities of scientific expertise to be meaningfully employed ("scientific" unemployment) forcing them to fill the ranks of "applicant teachers"

b. the domination of traditional university disciplines over what happens to primary and secondary education (closely related to (a))

c. this domination, which was in the past limited within the ranks of the School of Philosophy of the University of Athens,[36] is recently extended to include the School of Science of the same University[37]

d. whereas other areas of knowledge require that university training takes into account the developments of science, technology, the economy and/or society at large, "education" and "teaching" at the secondary level does not need to do it, since the forces which shape the content of university studies control and determine at the same time what "education" and "teaching" in schools is.[38]

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[35]One should keep in mind that both "events" occurred at a time when the post of Secretary of Higher Education - at the Ministry of Education - was occupied by a person serving as assistant professor at the Department of Physics of the University of Athens. The courses he taught were on Computer Science.

[36]Rendering thus to the educational system its humanistic and abstract content character

[37]It is interesting to note that the University of Patras (and later the University of Crete) had pioneered in the establishment of Computer Departments since the beginning of the 80's, but had never the chance to promote the policies which the University of Athens promoted timely and fast.

[38]There is a long tradition of traditional disciplines' university professors serving on committees which develop education policies. The majority of the professors are usually professors at the University of Athens.

The introduction of informatics is clearly part of the continuous process whereby education and teaching is reduced to nothing more than the simplification of lower-order content, offered in the course of university studies. Within this context, it is practically impossible to expect that computer education in schools will develop into something more than the content of introductory programming and application packages. Subject matter domination, meaning in fact traditional university discipline domination, will be one of the major forces which will shape computer education in secondary (general) schools.

Popkewitz analyses the role of the University as a dynamic element in the management of society. The way that was achieved in the US case was by establishing "business ideologies of efficiency and accountability in the organization of the state and its multiple institutions, such as the school, ... the inclusion of university categories of knowledge into schools with a consequence of legitimating both the knowledge and its 'holders'. By making particular occupation work a subject of schooling, an occupation is given status ..... the school placement stresses the importance of the subject and the experts who 'own' that knowledge"[39].

In Greece the situation is much more bold and acute. Not only do university professors control educational policy at all levels. They can also "match" the "knowledge" to become part of the school curriculum with the content, and therefore the "products", of their own Departments in a very unique way:

Their ability to control both gives them the possibility to dictate what happens in schools on the basis of what their graduates have studied. University studies leading to secondary school teaching posts are traditional discipline-related, without any concern for educating the young. That means there is no concern or effort to study, research, or employ research findings to the issue of educating the young. Therefore a chemistry teacher is in fact a chemist. He turned into a teacher by the mere fact that he applied to be included in the "Yearbook of Teachers-chemists", no more, no less. Once s/he becomes a teacher he teaches the rudimentary knowledge in the official textbook following the state curriculum prepared by other "teachers" like him/her.

[39]Popkewitz (1987) p.14. The emphasis is mine.

5. The introduction of computers as the reproduction of old practices

At the beginning of the introduction of computers in schools things were different. Athens University had no Computer Science Department in the mid 80's. The international imperatives for the new technology as well as political expediency though, could not wait. So computers were introduced in the schools and the Ministry tried to mobilize the available resources, meaning experienced teachers. This was partly due to the fact that budgetary constraints did not allow for any new hiring at that time. So the Ministry had to exploit, as much as possible, existing teacher resources who had developed an interest in using the computers. The fact is that in some cases this interest turned out to be a quite innovative and creative involvement as isolated but important examples - including the group associated with the research unit at the University of Patras -have shown so far. The proliferation of new developments such as the "Yearbook of Teachers in Informatics" and the national curriculum under way have not only suppressed these real possibilities, they have also established the conditions for the usual course of events in educational policy making. Which, in fact, is more than likely to be realized without leaving many possibilities open for the creative use of computers at the secondary level.

The educational system's functioning, in its effort to respond to the international imperatives of both new technologies as well as new markets, could not but create a rupture. This consisted and was revealed in the first phase by the inability to finance the purchase of computers due to the need for heavy military expenditure versus other expenditure - as compared with other European counties. It was further revealed as the inability to design in a relatively short time the "curriculum" for the introduction of computers in schools, as well as the great difficulty in designating teachers to carry out whatever the "curriculum" might indicate. It is this rupture which created the potential for teachers to take some of the initiative in their hands, to promote their own work and alternative views on the educational uses of computers into policy and practice. Furthermore it allowed their (the teachers') ex ante, but actual nevertheless, participation in the international knowledge production regarding the use of logo in the schools as well as the educational uses of computers, following the PC's "revolution".. Needless to say that technical as well as substantive knowledge was limited. But there was a "conscientization" to the fact that there is an internationally well-known model

based on educational criteria and approaches which the teachers could pursue vis a vis the prevailing view of the "engineers" and scientists.
This "conscientization" made the group of teachers in the Patras area to voice their concerns and propose Logo to become an option to be allowed as a possible programming language alternative in the 1988 Ministry sponsored training Seminars. The relaxation in the strict procedural approval of the Working Group's technocentric content and methods allowed for the viability of such an alternative proposal. For the relaxation of procedures was due and made possible by the fact that the Pedagogic Institute had no expertise nor legitimate function to perform in the making of the informatics education. Therefore there was no knowledge-power and control to enforce the related teacher training topics by refusing the acceptance of alternatives.

Today, the process has been completed with a) a planned massive purchase of hardware[40] which will bring computers in the majority of the country's (lower) secondary schools, b) a relatively expanded curriculum which has been drafted[41], and c) a "teaching" force which has been secured. So, informatics, or computer education, is increasingly forced into the mainstream curriculum and more than ever put under the control of the forces which shape secondary education.
Informatics education seems heading towards informatics and not education the same way mathematics and physics, for secondary schools did in the past.

This is very disturbing of course. But what makes it look more than disturbing, is the prospects ahead.
In order to be able to have a clear indication of future prospective developments in this issue we need to examine what has happened recently in the science and mathematics education.
The existence of the newly established Departments of Education at the University level and the issues of re-training of primary school teachers re-opened the question of science and mathematics teacher training. As a result the Minister

[40]A total of 6.600 PC's is envisaged for approximately 800 additional schools - out of the 1.300 remaining without hardware
[41]See for example Working Group of the Ministry of Education (1992) "Proposal of the Working Group for the Informatics Curriculum of Primary and Lower Secondary Education". Athens, July (in Greek)

of Education invited the Deans of the Faculties of Mathematics and Science to develop a program for the training of teachers in the corresponding fields.[42]
Needless to say that after two years of deliberation there is no solution as yet. And it is very unlikely that there will be one. Because, if the obvious solution of two specializations per Department would be adopted (one for mathematicians - for example and one for mathematics teachers) it is very clear in the Deans' mind which specialization the students will opt for.[43]
So it is very unlikely that the issue of teachers education for secondary education will be resolved in the immediate future in favor of education. If this is the case, the developments in computer education present a very gloomy picture, since it is very likely that the mathematics and science structure will be reproduced. More importantly it will be reproduced in an educational activity which clearly has implications in the cultural domain and the social functions of schooling. at least as much as science and mathematics does.

Extention:
In this case there is something more than knowledge, content curriculum and the like: there is the "artifact" of the technology which "embodies" specific practicies independent of the everyday educational practice. What are the implications? Especially in the abstract theory laden educational practice in Greece? What are the implications of "social reproduction" in the of technological expertise and skills? e.g. a " new" inequality? (gender)

Epilogue

Papert insightfully states "The context for human development is always a culture, never an isolated technology. In the presence of computers, cultures might change and with them people's ways of learning and thinking. But if you want to understand the change, you have to center your attention to the culture not the computer".[44] Murray-Lasso is definitely aware of the intricacies in introducing a new (and foreign) technology and lists 12 "constraints" imposed by culture. When analysing curricular differences and teachers approaches he mentions a good

[42]These are (up until today) trained in the specific discipline without any knowledge in the education sciences.
[43]The question then is how these Departments will justify their existence and the social usefulness of the education offered in light of those empty classes?
[44]Papert (1987) The emphasis is mine.

number of differences between the countries that produce the new technologies, and the rest of the world, such as: differences in the content of subjects, in educational ideology, differences in teaching styles and approaches (eg. dogmatic, authoritarian, content transmitting, etc) all of which are context bound, that is derive from the society in which education is considered[45].

Culture and society thus become once more a decisive factor in viewing education, technology, and, even more, both.

[45]Murray-Lasso (1990).